Simulations of Recovery of Time-Varying Gravity from DECIGO Pathfinder

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We simulated time-varying Earth's gravity field recovered from DPF to evaluate an impact of DPF and future satellite gradiometry mission on earth science. From hydrological water movement data and orbit information, gravity gradients to be measured at altitude about ~500km were generated. Errors caused by atmospheric and oceanic variations and instrumental noise were added. Monthly gravity fields were estimated solving normal equations between spherical harmonic coefficients and simulated gravity gradient data.

Simulation results show that DPF likely provides monthly hydrological water storage change with spatial scale between 400 and 1000km.
Sensitivities to large scale estimates depends on long-term stability of gravity gradient measurement, and errors in short scale estimates are caused by instrumental noise and imperfections in atmospheric and ocean model.

With acceleration noise level is lower than ~5 x 10-14 [m/s2/sqrtHz] at frequency higher than 3mHz, water storage changes at limited small basins will be provided by DPF. To monitor continental scale hydrological water movement, noise level must be lower than ~5 x
10-14 [m/s2/sqrtHz] at frequency higher than 1mHz.